

REMARKS

The Official Action dated April 8, 2005, has been carefully considered. Applicant appreciates the Examiner's thorough review of the application. Applicant also wishes to thank the Examiner for his indication of allowance of claims 11 and 30. Consideration of the changes and remarks presented herein and reconsideration of the rejections are respectfully requested.

By the present amendment, claims 1, 6, 8, 16, 26 and 39 have been amended. Support for the amendments can be found in the specification (e.g., page 8, line 15 to page 9, line 1), claims and drawings as originally filed. Accordingly, claims 1-48 stand pending in this application. As set forth below, it is believed that claims 1-48 are in condition for allowance. It is believed that these changes do not involve any introduction of new matter, whereby entry is believed to be in order and is respectfully requested.

In the Official Action, the Examiner rejects claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 under 35 U.S.C. § 102(b) as being anticipated by Fang et al (U.S. Patent No. 5,771,318). Applicant respectfully traverses this rejection for the reasons stated more fully below.

As will be set forth in detail below, it is submitted that the methods for enhancing a digital image and software operable to produce an enhanced image by implementing a method as defined by claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 are not anticipated by and are patentably distinguishable from Fang et al. Accordingly, this rejection is traversed and reconsideration is respectfully requested.

The methods for enhancing a digital image as defined by claim 1, on which claims 2-10 and 12-15 depend, include providing a digital original image comprising a plurality of pixels, wherein each pixel includes an original value corresponding to a characteristic of the image, calculating a dynamic image mask value for each pixel by averaging the original

value of a pixel with the original values of the pixels proximate that pixel, and applying the dynamic image mask value to the original value for each corresponding pixel using a mathematical function to control contrast and produce an enhanced image having improved detail.

The software tangibly embodied in a computer readable medium and operable to produce an enhanced image by implementing a method as defined by claim 26, from which claims 27-29 and 31-38 depend, includes generating a dynamic image mask from a digital original image, the dynamic image mask and the original image each having a plurality of pixels having varying values, wherein the values of the plurality of dynamic image mask pixels are set to form sharper edges corresponding to areas of more rapidly changing pixel values in the original image and less sharp regions corresponding to areas of less rapidly changing pixel values in the original image and combining the dynamic image mask with the original image to control contrast and produce the enhanced image having improved detail.

In contrast, Fang et al disclose an adaptive edge-preserving smoothing filter to effectively reduce noise levels while preserving fine structures in data (col. 3, lines 11-12). Fang et al teach an adaptive edge-preserving filter developed as a smoothness constraint from an iterative PET image reconstruction scheme (col. 3, lines 46-50).

Rejection for anticipation or lack of novelty requires, as the first step in the query, that all elements of the claimed invention be described in single reference. Applicant is unable to find any teaching or disclosure by Fang et al of the methods or software as defined by independent claims 1 and 26. With regard to independent claim 1, Applicant finds no teaching or disclosure in Fang et al applying a dynamic image mask value to the image value for each corresponding pixel using a mathematical function to control contrast and produce an enhanced image having improved detail. Rather, Fang et al teach a final compute means

which provides for the possibility to control the degree of smoothing which occurs. Fang et al do not suggest that the final compute means provides for control of contrast and produces an enhanced image having improved detail. The functionality taught by Fang et al serves a substantially different purpose, and therefore does not teach the invention as recited in claim 1.

With respect to claim 26, Fang et al do not teach combining the dynamic image mask with the original image to control contrast and produce the enhanced image having improved detail. The teachings in Fang et al are directed to only sharpening and preserving edges of an image. Moreover, as previously asserted, Fang et al teach "controlling smoothing" of an image, but provides no teaching of "controlling contrast" when the dynamic image mask is combined with the original image producing an enhanced image having improved detail.

As such, Fang et al fail to teach or disclose the presently claimed inventive methods and software as defined by independent claims 1 and 26. In view of the deficiencies of Fang et al to teach the methods or software as set forth in claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37, the presently claimed invention is not taught or disclosed by Fang et al.

It is therefore submitted that the methods and software as defined by claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 are not anticipated by and are patentably distinguishable from Fang et al and the rejection of claims 1, 10, 13, 15, 26-29, 32, 33, 35 and 37 under 35 U.S.C. § 102 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 2-6, 8, 13-14, 16-20 and 23-25 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al as applied to claim 1 above, and further in view of Fujimoto et al (U.S. Patent No. 5,771,107). The Examiner incorporates his arguments from above regarding Fang et al. The Examiner notes that Fang et al fail to expressly disclose a method for capturing image data. The Examiner contends however, that

Fujimoto et al disclose a scanner for reading images, and as such held that it would have been obvious to one reasonably skilled in the art to modify the enhancement system disclosed in Fang et al by adding an image sensor for acquiring images as taught by Fujimoto et al.

As will be set forth in detail below, it is submitted that the methods and systems of claims 2-6, 8, 13, 16-20 and 23-25 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Fujimoto et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Claims 2-6, 8 and 13-14 depend from claim 1. Arguments as to why claim 1 is patentably distinct from the teachings of Fang et al have been presented above. Moreover, the deficiencies of Fang et al with respect to claim 1 are not overcome by Fujimoto et al. Fujimoto et al is directed to an image processor which processes an image to be copied with attention to the detection of black edges to produce clear color copy outputs. Fujimoto et al does not teach applying a dynamic image mask value to the image for each corresponding pixel using a mathematical function to control contrast and produce an enhanced image having improved detail.

As defined by claim 16, from which claims 17-20 and 23-25 depend, the present invention is directed towards a system including a sensor system operable to produce electronic signals corresponding to certain characteristics of a subject, a processor operable to receive the electronic signals and produce image values for each pixel, and a memory media having software stored thereon, wherein the software is operable to calculate a dynamic image mask value for each pixel by averaging the image value of a pixel with the image values of the pixels proximate that pixel and apply the dynamic image mask value to the image value for each corresponding pixel using a mathematical function to control contrast and produce an enhanced image having improved detail within a reproducible dynamic range.

In order for references to be relied upon to support a rejection under 35 U.S.C. § 103 they must provide an enabling disclosure, i.e., they must place the claimed invention in the possession of the public. Applicant finds no teaching or suggestion by Fang et al alone or in combination with Fujimoto et al of a system as set forth by independent claim 16. As defined by claim 16, the system includes a memory media having software stored thereon, wherein the software is operable to apply the dynamic image mask value for each corresponding pixel using a mathematical function to control contrast and produce an enhanced image having improved detail within a reproducible dynamic range. As previously asserted, Fang et al fail to teach such a limitation. Moreover, Applicant found no teaching or suggestion in Fujimoto et al to make up for the deficiency of Fang et al, and Fujimoto et al have not been cited in the Office Action for such purpose. As such, Fang et al alone or in the argued combination with Fujimoto et al fail to teach the presently claimed methods and systems.

It is therefore submitted, that the presently claimed methods and systems for enhancing digital images as defined by claims 2-6, 8, 13-14, 16-20 and 23-25 are non-obvious over and patentably distinguishable from Fang et al in view of Fujimoto et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 39-44 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al as applied to claim 26 above, and further in view of Fujimoto et al. The Examiner asserts similar arguments, but also suggests that Fujimoto et al disclose a color decoder operably connected to the image sensor to generate color image data. Moreover, the Examiner contends that the complementary color reversing circuit disclosed in Fujimoto et al is analogous to the claimed color management system.

However, as will be set forth in detail below, it is submitted that the systems of claims

39-44 are non-obvious and patentably distinguishable from the teachings of Fang et al as applied to claim 26 and in further view of Fujimoto et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Claim 39, from which claims 40-48 depend, includes a system having an image sensor to convert light reflected from an image into information representative of the image, a processor, memory operably coupled to the processor, and a program of instructions capable of being stored in the memory and executed by the processor, the program of instructions to manipulate the processor to: obtain a dynamic image mask, the dynamic image mask and the information representative of the image each including a plurality of pixels having varying values, wherein the values of the plurality of dynamic image mask pixels are set to form sharper edges corresponding to areas of more rapidly changing pixel values in the original image and less sharp regions corresponding to areas of less rapidly changing pixel values in the original image; and combine the dynamic image mask with the information representative of the image to control contrast and obtain a masked image having improved detail within a reproducible dynamic range.

Fang et al fail to teach to combine dynamic image mask with the information representative of the image to control contrast and obtain a masked image having improved detail within a reproducible dynamic range. Moreover, Applicant found no teaching or suggestion in Fujimoto et al to make up for the deficiency of Fang et al, and Fujimoto et al have not been cited in the Office Action for such purpose. As such, Fang et al alone or in the argued combination with Fujimoto et al fail to teach the presently claimed systems.

It is therefore submitted, that the presently claimed systems as defined by claims 39-44 are non-obvious over and patentably distinguishable from Fang et al as applied to claim 26 above, and further in view of Fujimoto et al whereby the rejection under 35 U.S.C. §103 has

been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 21, 22 and 45-48 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the combination of Fang et al and Fujimoto et al as applied to claims 16, 39 and 42 above, and further in view of Tretter et al (U.S. Patent No. 5,867,606).

Tretter et al disclose an apparatus and method for determining the appropriate amount of sharpening for an image (col. 1, lines 7-10). Particularly, the system sharpens or enhances an original image (e.g., a digital image) (col. 1, lines 14-16).

As previously asserted, Fang et al and Fujimoto et al fail to teach the limitations of independent claims 16 and 39, from which claims 21, 22 and 45-48 depend. The teachings of Tretter, particularly a method for determining the amount to sharpen an image, do not overcome the deficiencies of Fang et al and Fujimoto et al because Tretter does not teach or suggest applying or combining a dynamic image mask to/with an original image to control contrast producing an enhanced image having improved details.

It is therefore submitted, that the presently claimed systems for enhancing digital images as defined by claims 21, 22 and 45-48 are non-obvious over and patentably distinguishable from combination of Fang et al and Fujimoto et al as applied to claims 16, 39 and 42 above, and further in view of Tretter et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 7 and 34 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Qian (U.S. Patent No. 6,707,940). The Examiner notes that Fang et al fail to expressly disclose the claimed formula for determining weighted original values. However, the Examiner asserts that Qian discloses using the claimed formula to calculate "smoothing factors" and contends that these smoothing factors

are analogous to the weighted original values.

However, as will be set forth in detail below, it is submitted that the methods and software of claims 7 and 34 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Qian. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Qian discloses a method and apparatus that smoothes images within regions but not across boundaries (abstract). Moreover, the Qian disclosure is directed towards image process, particularly, image segmentation (col. 1, lines 7-8).

Claim 7, which depends from claim 1, and claim 34, which depends from claim 26 both include a limitation setting forth a particular mathematical formula for determining weighted original values. As previously asserted the claims 1 and 26 are not taught by Fang et al. Applicant found no teaching or suggestion in Qian to make up for the deficiency previously set forth regarding Fang et al, and Qian has not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods and software as defined by claims 7 and 34 are non-obvious over and patentably distinguishable from combination of Fang et al in view of Qian whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 12 and 31 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Paik (U.S. Patent No. 6,370,279). The Examiner notes that Fang et al fail to teach histogram leveling. However, the Examiner asserts that the histogram equalization disclosed in Paik is analogous to the histogram leveling.

However, as will be set forth in detail below, it is submitted that the methods and

software of claims 12 and 31 are non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Paik. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Paik discloses an image processing system (col. 1, lines 6-7). More particularly, Paik describes a block-based image processing method capable of removing blocking artifacts, caused by another block-based image process, by using spatial adaptive filtering based on an image restoration theory (col. 2, lines 50-54).

Claim 12, which depends from claim 1, and claim 31, which depends from claim 26 both include a limitation including histogram leveling. As previously asserted, claims 1 and 26 are not taught by Fang et al. Applicant found no teaching or suggestion in Paik to make up for the deficiency previously set forth regarding Fang et al, and Paik has not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods as defined by claims 12 and 31 are non-obvious over and patentably distinguishable from combination of Fang et al in view of Paik whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

In the Official Action, claims 9 and 36 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Wober et al (U.S. Patent No. 5,729,631). The Examiner notes that Fang et al fail to disclose the generation of the dynamic image mask which includes performing a pyramidal decomposition on the original image. However, the Examiner contends that Wober et al disclose performing a pyramidal decomposition on the original image in the generation of an image mask.

However, as will be set forth in detail below, it is submitted that the methods and software of claims 9 and 36 are non-obvious and patentably distinguishable from the

teachings of Fang et al in further view of Wober et al. Accordingly this rejection is traversed and reconsideration is respectfully requested.

Wober et al disclose improved methods and apparatus for image processing, particularly to processes and systems for removing noise from an image by using discrete cosine transforms in a multi-level pyramid image representation (col. 1, lines 20-24).

Claim 9, which depends from claim 1, and claim 36, which depends from claim 26 both include a limitation of performing a pyramidal decomposition on the original image. As previously asserted the claims 1 and 26 are not taught by Fang et al. Applicant found no teaching or suggestion in Wober et al to make up for the deficiency previously set forth regarding Fang et al, and Wober et al have not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed methods and software as defined by claims 9 and 36 are non-obvious over and patentably distinguishable from combination of Fang et al in view of Wober et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

Finally, in the Official Action, claim 38 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Fang et al in view of Hu et al (U.S. Patent No. 6,668,097). The Examiner notes that Fang et al fail to disclose software operable to perform the steps of the disclosed method is stored on a digital camera. However, the Examiner contends that Hu et al disclose a similar image processing method which is operable to be executed on a digital camera.

However, as will be set forth in detail below, it is submitted that the software of claim 38 is non-obvious and patentably distinguishable from the teachings of Fang et al in further view of Hu et al. Accordingly this rejection is traversed and reconsideration is respectfully

requested.

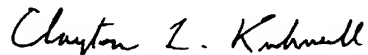
Hu et al disclose an image processing system receiving a decompressed image and having an edge detector identifying edges between contrasting regions of pixels or the image (col. 2, lines 10-13).

Claim 38, which depends from claim 26, includes a limitation of having the software resident on a digital camera. As previously asserted the claim 26 is not taught by Fang et al. Applicant found no teaching or suggestion in Hu et al to make up for the deficiency previously set forth regarding Fang et al, and Hu et al have not been cited in the Office Action for such purpose.

It is therefore submitted, that the presently claimed software as defined by claim 38 is non-obvious over and patentably distinguishable from combination of Fang et al in view of Hu et al whereby the rejection under 35 U.S.C. §103 has been overcome. Reconsideration is respectfully requested.

It is believed that the above represents a complete response to the Examiner's rejections under 35 U.S.C. §§102 and 103, and places the present application in condition for allowance. Reconsideration and an early allowance are respectfully requested.

Respectfully submitted,



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